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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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EXAMINER

NGUYEN, KHIEM D

ART UNIT

PAPER NUMBER

2823

DATE MAILED: 04/14/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/838,493

Applicant(s)

Examiner

Khiem D Nguyen

Art Unit

2823

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 17 January 2003.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-9, 11-14, 16-41 and 43-57 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-9, 11-14, 16-41 and 43-57 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 19 April 2001 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ 6) ☐ Other: _____

DETAILED ACTION

Allowable Subject Matter

The indicated allowability of claims 12-14, 25-27, 33, 35, 45, and 47 is withdrawn in view of the newly discovered reference(s) to Charneski et al. (U.S. Patent 6,284,652), JP 2000351622 and Calvert et al. (U.S. Pub. 2002/0134684). Rejections based on the newly cited reference(s) follow.

Response to Amendment

Responding to applicant's Arguments

Applicant's arguments with respect to claims 1-9, 11-14, 16-41, and 43-57 have been considered but are moot in view of the new ground(s) of rejection.

New Grounds of Rejection

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

1. Claims 1-9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lu et al. (U.S. 2002/0100693) in view of Charneski et al. (U.S. Patent 6,284,652) and Ho et al. (U.S. Patent 6,261,954).

Lu teaches a method of metallizing a substrate, comprising (See paragraphs [0012] to [0020] and FIGS. 1-2D):

depositing on the substrate 102 a dual-purpose layer 114 comprises a material capable of reducing diffusion of the conductive interconnect material into surrounding materials (Paragraph [0017]), and wherein the dual-purpose layer comprises a material having a resistivity that allows electrochemically deposition of the conductive interconnect material (paragraph [0023]);

electrochemically reducing oxides on the surface of the dual-purpose layer using a first electrolyte where the first electrolyte is the cation of the anode in an electrochemical reaction (paragraph [0019]); and,

electrochemically depositing a conductive interconnect layer 120 comprises copper on the surface of the dual-purpose layer (Paragraph [0022]).

Lu fails to explicitly disclose electrochemically depositing a conductive interconnect layer on the surface of the dual-purpose layer using a second electrolyte as recited in present amended claim 1.

Charneski discloses electrochemically depositing a conductive interconnect layer 48 on the surface of the dual-purpose layer using a second electrolyte wherein the conductive interconnect comprises copper and the electrolyte comprises copper sulfate and wherein the first electrolyte is the cation of the anode in an electrochemical reaction cell (col. 8, lines 12-41 and FIG. 4). It would have been obvious to one of ordinary skill in the art of making semiconductor devices to combine the teaching of Lu and Charneski to enable the conductive interconnect layer of Lu to be formed and furthermore to control the nature of the copper deposit (col. 8, line 29).

Lu fails to teach wherein the dual-purpose layer comprises tungsten as recited in present claims 3-4.

Ho teaches a dual-purpose layer 18 comprises tungsten (col. 3, lines 30-41 and FIG. 6). It would have been obvious to one of ordinary skill in the art of making semiconductor devices to incorporate Ho's teaching into Lu's method because in doing so the dual-purpose layer comprises of tungsten can eliminate out-diffusion of copper ions from the interconnect (col. 3, lines 30-41).

Lu fails to teach the ranges of the voltage and current applied during both the electrochemically reducing and depositing step as recited in present claims 6-9.

However, there is no evidence indicating that the voltage and current applied during both the electrochemically reducing and depositing step are critical and it has been held that it is not inventive to discover the optimum or workable ranges of a result-effective variable within given prior art conditions by routine experimentation. See MPEP 2144.05.

2. Claims 11-14, 16-41, and 43-57 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lu et al. (U.S. 2002/0100693) in view of Charneski et al. (U.S. Patent 6,284,652), JP2000351622, Ho et al. (U.S. Patent 6,261,954) and Calvert et al. (U.S. Pub. 2002/0134684).

Lu teaches a method of metallizing a substrate, comprising (See paragraphs [0012] to [0020] and FIGS. 1-2D):

depositing on the substrate 102 a dual-purpose layer 114 (paragraph [0023]);

electrochemically reducing oxides on the surface of the dual-purpose layer in an electrochemical reaction cell comprising an anode formed from a material that can be oxidized in the presence of the material comprising the dual-purpose layer (paragraph [0019]); and,

electrochemically depositing a conductive interconnect layer 120 comprises copper on the surface of the dual-purpose layer wherein the electrochemically reducing step and the electrochemically depositing step are performed in a single electrochemical reaction cell using a single anode (Paragraph [0022]).

Lu teaches wherein the first electrolyte comprises the cation of the material from which the conductive interconnect layer is made a complexing agent (boric acid H_3BO_3) and a pH control agent (tetramethyl ammonium hydroxide $(\text{CH}_3)_4\text{NOH}$) wherein the electrolyte exhibits a pH (≥ 4) ([paragraph 0020]). Thus, there is no evidence indicating that the pH ranges as recited in present claims 38-41 and 50-53 are critical and it has been held that it is not inventive to discover the optimum or workable ranges of a result-effective variable within given prior art conditions by routine experimentation. See MPEP 2144.05.

Charneski discloses electrochemically depositing a conductive interconnect layer 48 on the surface of the dual-purpose layer using a second electrolyte wherein the conductive interconnect comprises copper and the electrolyte comprises copper sulfate and wherein the electrochemical reaction cell or bath contains a first electrolyte comprising the cation of the material used to form the anode (col. 8, lines 12-41 and FIG. 4). It would have been obvious to one of ordinary skill in the art of making

semiconductor devices to combine the teaching of Lu and Charneski to enable the anode of Lu to be formed such that the electrochemically reducing step is performed in a first electrochemical reaction cell using a first anode and the electrochemically depositing step is performed in a second electrochemical reaction cell using a second anode.

Lu fails to teach where in the anode is formed from titanium or titanized platinum as recited in present claims 11 and 13. However, the use of titanium or titanized platinum in forming the anode is well-known to one of ordinary skill in the art of making semiconductor devices.

None of the references disclose wherein the first electrolyte comprises titanium trichloride and titanium sulfate as recited in present claims 13-14, 26, and 27.

JP2000351622 discloses wherein the first electrolyte comprises titanium sulfate having a complexing agent a pH control agent (0-5) and wherein the first anode is formed from titanium (Abstract). It would have been obvious to one of ordinary skill in the art of making semiconductor devices to combine the teaching of Lu and JP2000351622 to enable the first electrolyte of Lu to be formed.

Lu fails to teach wherein the dual-purpose layer comprises tungsten as recited in present claims 20-21 and 43.

Ho teaches a dual-purpose layer 18 comprises tungsten (col. 3, lines 30-41 and FIG. 6). It would have been obvious to one of ordinary skill in the art of making semiconductor devices to incorporate Ho's teaching into Lu's method because in doing so the dual-purpose layer comprises of tungsten can eliminate out-diffusion of copper ions from the interconnect (col. 3, lines 30-41).

Lu fails to teach the ranges of the voltage and current applied during both the electrochemically reducing and depositing step as recited in present claims 28-31 and 54-57.

However, there is no evidence indicating that the voltage and current applied during both the electrochemically reducing and depositing step are critical and it has been held that it is not inventive to discover the optimum or workable ranges of a result-effective variable within given prior art conditions by routine experimentation. See MPEP 2144.05.

None of the references disclose wherein the complexing agent is ethylene diamine tetra acetate as recited in present claim 47.

Calvert discloses wherein the complexing agent is ethylene diamine tetra acetate (paragraph [0050]) as recited in present claims 35 and 47. It would have been obvious to one of ordinary skill in the art of making semiconductor devices to combine the teaching of Lu and Calvert to enable the complexing agent of Lu to be formed.

Conclusion


Any inquiry concerning this communication or earlier communications from the examiner should be directed to Khiem D Nguyen whose telephone number is (703) 306-0210. The examiner can normally be reached on Monday-Friday (8:00 AM - 5:00 PM).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Chaudhuri Olik can be reached on (703) 306-2794. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 746-9179 for regular communications and (703) 746-9179 for After Final communications.

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Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

K.N.
April 5, 2003


C. K. Chaudhury
Supervisory Patent Examiner
Technology Center 2800